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ABSTRACT (MAXIMUM 200 WORDS) Through the spread of biological pathogens and viruses, bioterrorism and infectious diseases are deemed as unconventional security threats that endanger the global community while overwhelming vital systems and infrastructure. Biosecurity addresses these threats by strengthening the detection and surveillance systems, and preparing states to respond effectively in the event of a catastrophic biological event. States are required to integrate various efforts in order to develop a coherent and effective biosecurity strategy. Due to increasing globalization, International cooperation and coordination are also vital to address the biological threats. Currently, great emphasis has been placed on developing technological-based solutions to counter such threats. However, there are two critical elements that should not be neglected. First, the population's mental resiliency to response and recover against a catastrophic biological event. Second, developing a system to leverage on community-based civil resources to ensure a high level of responsiveness. Finally, integration of biosecurity efforts at all level and across all pertinent sectors will be crucial to stage an effective global defense against bioterrorism and infectious disease.			
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*United States Marine Corps
Command and Staff College
Marine Corps University
2076 South Street
Marine Corps Combat Development Command
Quantico, Virginia 22134-5068*

MASTER OF MILITARY STUDIES

**BIOSECURITY: ADDRESSING THE THREATS OF BIOTERRORISM AND
INFECTIOUS DISEASE**

SUBMITTED IN PARTIAL FULFILLMENT
OF THE REQUIREMENTS FOR THE DEGREE OF
MASTER OF MILITARY STUDIES

AUTHOR: MAJ LEAD SHUAN PANG

4 MAR 2010

AY 09-10

Mentor and Oral Defense Committee Member: Paula Otis, Ph.D.

Approved: BGO

Date: 4 March 2010

Oral Defense Committee Member: Edward J. Erickson Ph.D.

Approved: E. Erickson

Date: 4 March 2010

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MAJOR LEAD SHUAN PANG
SINGAPORE ARMY
CONFERENCE GROUP #12

4 MAR 2010

MMS Advisor: DR. PAULETTA OTIS, PH.D.

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PREFACE

The H1N1 influenza pandemic has raised global concerns on the need to cooperate and coordinate efforts to counter the spread of infectious diseases at the national and international level. At the same time, states have allocated significant resources to combat against the increasing threat of bioterrorism. I believe that both infectious diseases and bioterrorism should be addressed under the security umbrella defined as biosecurity.

The ability of Singapore to effectively respond against the Severe Acute Respiratory Syndrome (SARS) crisis in 2003 provided the primary motivation behind my interest in biosecurity. By analyzing the biosecurity efforts of United States and Singapore, I hoped to draw certain key elements of biosecurity that may require greater focus in the current fight against the above-mentioned biological threats. I have also attempted to analyze the international efforts to assess their overall effectiveness.

This has been a wonderful journey and I am glad to have the opportunity to research on this subject. I would like to sincerely thank my MMS mentor Dr. Pauletta Otis for her guidance and patience.

MMS - EXECUTIVE SUMMARY

Title: Biosecurity: Addressing the Threats of Bioterrorism and Infectious Diseases

Author: Major Lead Shuan PANG / Singapore Army / CG#12

Thesis: The combination of bioterrorism and the spread of infectious diseases have presented the world with an increasingly significant unconventional security threat. Biosecurity serves to link public health issues with national security in order to holistically combat against these biological threats.

Discussion: Biological threats can be divided into the intentional use of biological weapons as a form of terrorist attack and the natural outbreak of an infectious disease. Although there have been relatively few cases of bioterrorism in the past, lower technological and cost barrier coupled with fresh intelligence reports show an increasing likelihood of a bioterrorist attack. At the same time, globalization has allowed the transmission of dangerous pathogen to ignore traditional political and geographical boundaries. The current influenza pandemic (H1N1) demonstrates the immense negative impact on the global health, economic, and socio-political situation as well as the challenges in trying to contain the disease spread.

Biosecurity typically comprise of two key elements - the first focuses on the prevention, detection, and surveillance while the second is about preparedness, response, and recovery. Prevention, detection, and surveillance require states to concentrate their efforts on intelligence gathering on potential bioterrorist and establishing effective epidemiological surveillance systems to detect disease outbreaks. Meanwhile, one of the most effective ways to achieve better preparedness, response and recovery against biological threats is to conduct scenario-based exercises. There are many inherent challenges to biosecurity, such as integrating biosecurity, resource allocation, and infringement on civil liberties. These challenges need to be addressed as states develop their biosecurity strategy so as to combat biological threats effectively and efficiently.

National and international efforts are vital to minimize the risks of biological threats. Using United States and Singapore as example, there are similar themes within their biosecurity strategies despite the vast difference in size, scale and available resources. These themes include better coordination and integration between governmental agencies, investing in technological-based countermeasures, and conducting national-level emergency exercises to enhance the states' capacity to handle biological threats. However, more emphasis needs to be placed on instilling greater mental resiliency within the population and leveraging on community-based civil resources to better respond against a bioterrorist attacks or an infectious outbreak. At the international level, the Biological Weapon Convention (BWC) and World Health Organization (WHO) continue to act as key platforms to synchronize efforts to counter the threats from the global perspective. Moving forward, these international organizations need to strengthen the linkages with each other in order to optimize the various biosecurity efforts in a coherent and unified manner.

Conclusion: Biosecurity will continue to dominate our security environment as the world continues to globalize. Both bioterrorism and infectious disease will likely be more prevalent and threatening against the global health system and national security. These threats will require a wide array of governmental and non-governmental entities to commit towards greater integration in biosecurity efforts. Only by adopting an integrated approach towards biosecurity can the risk of biological threats be effectively reduced.

FOREWORD

I was honored to play the part of the President in the exercise *Dark Winter*.... You often don't know what you don't know until you've been tested. And it's a lucky thing for the United States that, as the emergency broadcast network used to say, 'this is just a test, this is not a real emergency.' But Mr. Chairman, our lack of preparation is a real emergency.

The Honorable Sam Nunn in testimony before the House Government Reform Committee, Subcommittee on National Security, Veterans Affairs and International Relations, July 23, 2001

Since the dawn of civilization, infectious diseases have shaped the course of human history. During the 20th century, we made remarkable progress in advancing public health, but in many ways we are currently more vulnerable than ever. Today, a tremendous interconnectedness brings the global community together and provides new opportunities for ... advancement. At the same time, however, it increases the potential for the spread of diseases ... which ignores geographic and political boundaries.

Foreword by U.S. President Barack Obama in the National Strategy for Countering Biological Threats, November 23, 2009

SARS ... has taught us a valuable lesson on how a medical crisis could develop quickly into a national crisis affecting more than the health sector. The SARS outbreak, however, does not give a complete picture of what we could face in a highly infectious influenza pandemic. While we are unable to predict how severe such a pandemic will be, we can certainly plan for it now and develop tough measures to minimise the impact and to speed up our recovery.

Foreword by Mr Wong Kan Seng, Singapore Deputy Prime Minister, Minister for Home Affairs and Chairman of Homefront Crisis Ministerial Committee (Avian Flu) in the Preparing for A Human Influenza Pandemic in Singapore, April 2009

TABLE OF CONTENTS

COVER PAGE	i
DISCLAIMER	ii
PREFACE	iii
EXECUTIVE SUMMARY	iv
FOREWORD	v
TABLE OF CONTENTS	vi
1. INTRODUCTION	1
2. BIOLOGICAL THREATS	2
2.1 BIOTERRORISM	2
2.2 SPREAD OF INFECTIONS DISEASE	4
3. BIOLOGICAL SECURITY.....	6
3.1 GENESIS OF BIOLOGICAL SECURITY	6
3.2 PREVENTION, DETECTION AND SURVEILLANCE	8
3.3 PREPAREDNESS, RESPONSE AND RECOVERY	9
3.4 CHALLENGES.....	9
4. NATIONAL EFFORTS	11
4.1 UNITED STATES' BIOSECURITY EFFORTS	11
4.2 SINGAPORE'S BIOSECURITY EFFORTS	13
5. INTERNATIONAL EFFORTS	16
6. FUTURE OF BIOSECURITY.....	18
7. CONCLUSION	20
APPENDIX A: DUAL PURPOSE DILEMMA OF BIODEFENSE RESEARCH	21
APPENDIX B: IMPACT OF BIOTECHNOLOGY ON BIOLOGICAL THREAT	22

ENDNOTES	23
BIBLIOGRAPHY	25

TABLE OF ILLUSTRATIONS

FIGURE 1. DEFENSIVE OR OFFENSIVE RESEARCH?	21
FIGURE 2. IMPACT OF BIOTECHNOLOGY ON BIOLOGICAL WARFARE	22

1. INTRODUCTION

Since the end of the Cold War and the demise of the Soviet empire, certain experts optimistically proclaimed the triumph of democracy over communism and predicted an era of peace and stability. Unfortunately, the period that ensued was marked by a rise of violence perpetrated by a myriad of state and non-state actors, as well as a heightened sense of threat and insecurity. Shifting from the conventional threat of states engaged in conflicts, the security climate began to be dominated by an array of unconventional and asymmetrical threats. Bioterrorism, gaining recognition over the past two decades, is viewed as one of the more prominent unconventional security threats.¹ Examples of bioterrorism include the contamination of several Western Oregon restaurants' salad bars with *Salmonella typhimurium* by the Rajneeshee religious sect in 1984 and the dissemination of anthrax spores through mailed envelopes in areas of New Jersey, New York and Washington D.C. in 2001.²

A more common and enduring form of biological threat has been the spread of infectious diseases. Throughout recorded history, infectious disease has consistently accounted for the greatest proportion of human morbidity and mortality, surpassing war and terrorism as the foremost threat to human life and prosperity.³ The current H1N1 influenza pandemic has demonstrated the ability to negatively impact the global population and economy while significantly straining the global health infrastructure.

Biosecurity is a form of study that focuses on the above-mentioned biological threats and develops measures to detect, prevent and counter against these threats. This paper depicts the dangers posed by the biological threats and the challenges faced by the security experts as well as health professionals to combat against these threats. It then provides an overview of the ongoing national and international efforts to prepare populations against such catastrophic events. Finally, it concludes by illustrating the future for biosecurity.

2. BIOLOGICAL THREATS

Regarding biological security, there are two major threats: a devastating event caused by biological terrorism and the development of a pandemic caused by Mother Nature. Both biological threats rely on the dispersion of biological agents to wreck havoc on the population and vital systems, such as communications and public health⁴. Both events would have second and third order effects that would increase the probability of massive casualties as well as political, social and economic instability. It is also important to recognize that the scientific research required to counter these threats can easily be used to develop and proliferate biological agents (See *Appendix A*).

There are specific differences between the two threats that require the biosecurity community, which comprises of security experts, governmental and military official, health professionals, and law enforcement agencies, to view them as distinct but overlapping problems. However, there is a sufficient overlap between the two threats that it makes sense to develop 'dual-use' strategies to counter against both threats at the same time, especially in the aftermath of a bioterrorist attack or an infectious disease outbreak.⁵

2.1 BIOTERRORISM

According to the United Nations, "Biological weapons are devices which disseminate disease-causing organisms or poisons to kill or harm humans, animals or plants. They generally comprise two parts – an agent and a delivery device. In addition to their military use as strategic weapons or on a battlefield, they can create social disruption, environmental problems or be used for assassinations."⁶

Biological warfare can be traced back as early as sixth century B.C. when the Assyrians poisoned enemy wells with rye ergot. Since then, states have been developing and producing biological weapons to inflict massive casualties in times of conflict. After World War II, the US and Soviet Union biological weapons programs continued to escalate as they

rushed to develop, test, produce and stockpile various biological weapons, including weaponized anthrax and missile-mounted smallpox.⁷ The level of biological warfare threat continues to increase as the world enters into an era of biotechnology (See *Appendix B*).

The use of biological weapons by states was eventually curtailed by establishment of the Biological Weapons Convention (BWC) in 1972. Currently, 163 state parties and 18 signatories have ratified or acceded to BWC.⁸ Although members of the BWC have openly renounced the use of biological weapons, the threat of biological weapons has not diminished as terrorist organizations continue to plot attacks that might involve biological weapons, thus giving to the term - Bioterrorism. Bioterrorism involves “the intentional use of an infectious agent – micro-organism, virus, infectious substance, or biological product – to cause death and disease in humans or other organism in order to influence negatively the conduct of government or intimidate a population.”⁹

Given the immense resources required to weaponize biological agents and the potential backlash of losing popular support by using such weapons, critics of bioterrorism have insisted that most terrorist groups do not possess the capability or the motivation to utilize biological weapons to achieve their objectives. Hence, these critics have doubted the probability of a large-scale biological terrorist attack.¹⁰ Even if an actual biological terrorist attack did occur, the complexity and unpredictable nature of the biological weapon would often cause such weapons to fail to achieve the intended consequences.

One good example of failed attempts by a bioterrorist group is the Japanese apocalyptic religious cult, Aum Shinrikyo. After expending enormous resources to develop biological weapons, the cult tried to execute biological weapons attacks six times and failed. When they finally managed to release the sarin gas in the Tokyo subway in March 1995, only 12 lives were lost.¹¹ Hence, it is not illogical to state that most terrorist groups would prefer the traditional, low-cost yet effective method of guns and explosives to carry out their attacks.

Although the process to cultivate viruses and subsequently to weaponize them is extremely tedious and costly, the technical barrier has been dramatically lowered over the past decade due to technological advancement and the accessibility of such information through the internet.¹² Certain terrorist groups are willing to use biological weapons, if it suits their objectives. These groups include religious-millenarian cults, such as Aum Shinrikyo, attempting to enact an apocalyptic event and violent religious fanatical groups, such as Al-Qaeda, plotting to strike at the United States and its allies.¹³ Recent *Washington Post* articles highlighting the possibility of utilizing the popular cosmetic drug Botox as a bioterrorist tool¹⁴ and warning that Al-Qaeda is still determined to acquire biological weapons¹⁵ demonstrate that bioterrorism should not be taken lightly.

Finally, the critics of bioterrorism have failed to acknowledge the potential effects a biological terrorist attack might have on an unsuspecting population and the vital systems which the population depends on, no matter how small-scale and limited the attack might be. According to Bruce Hoffman, the real threat is “not the destruction of an entire city depicted by fictional thriller-writers and governmental officials, but the more deliberate and delicately planned use of biological agents for more discrete purposes. In this respect, even a limited terrorist attack involving a biological weapon on a deliberately small scale could have disproportionately enormous consequences, generating unprecedented fear and alarm.”¹⁶

2.2 SPREAD OF INFECTIOUS DISEASE

In addition to bioterrorism, the other domain of biosecurity relates to emerging infectious disease. Unlike bioterrorism, infectious disease has been traditionally viewed as a public health issue, instead of a security issue. Previously, the common notion of the fight against infectious diseases would involve public health officials and medical researchers attempting to eradicate malaria or curb the spread of HIV. However, recent episodes of health crisis such as the Severe Acute Respiratory Syndrome (SARS), avian flu and H1N1 influenza

have revealed something much more sinister. These health crises have demonstrated a strong linkage between public health and national security as governments struggle to provide security for citizens amidst the spread of infectious disease and the accompanying fear and paranoia.

Although infectious diseases, which have existed for millennia, have been responsible for the deaths of millions and the collapse of a few ancient empires,¹⁷ the human species has always managed to overcome the diseases and survive. The current situation warrants much greater scrutiny. Over the years, the growth of megacities has created entirely new “disease pools” that will allow new pathogens to emerge and flourish while international trade and travel have risen dramatically and thus, promoted the unrestricted spread of infectious disease across the entire globe. Indeed, globalization has accelerated the diffusion, lethality, and resistance of infectious diseases.¹⁸

In addition to the enhanced threat posed to the general population, emerging infectious disease has also begun to threaten the security of our nations’ vital systems. According to Andrew Lakoff, vital systems refer to “critical systems that underpin social and economic life.”¹⁹ These systems include the emergency response and public health systems, the transportation and communication systems, and the immigration and law enforcement systems. Without a robust framework to detect and respond rapidly to the first signs of an infectious outbreak and implement measures to mitigate against the accompanying destabilizing effects on the society, the outbreak might develop into what former White House Homeland Security Advisor Richard Falkenrath described as a “catastrophic disease threat” which would eventually overwhelm our vital systems.²⁰

By the end of the SARS crisis in July 2003, the disease had afflicted 29 countries in the world and infected 8,427 people, of whom 813 died. Initially, several governments were unable to respond effectively to the SARS outbreak and faced severe strain on their vital

systems. In addition to the damage done to human life, the SARS crisis began to have devastating effects in the economic, social and political dimensions. It was estimated that SARS resulted in a worldwide financial loss of at least \$54 billion.²¹ Social bonds were tested in communities within affected cities when typical relationships of class, ethnicity, and gender became increasingly strained and tenuous. Politically, SARS led to a major legitimacy crisis for certain governments when citizens protested against the lack of positive results in stopping the disease while civil liberty groups reacted negatively to the harsh containment and isolation measures. Although the governments were able to recover from the initial shock and eliminated the biological threat, the SARS crisis still serves as a reminder of the potential devastation that could be unleashed on the population as well as the vital systems.

Presently, the world is faced with one of its gravest biological threat in decades as the pandemic influenza (H1N1) continues to rage throughout the globe. According to the World Health Organization (WHO), more than 208 countries and overseas territories or communities have reported laboratory-confirmed cases of pandemic influenza (H1N1), including at least 13,554 deaths.²² Such infectious disease does not distinguish territorial boundaries nor does it discriminate against any race, religion, age or social class. In its very essence, infectious disease threatens all human lives and creates a disproportionately destabilization effect on the peoples' way of life.

3. BIOLOGICAL SECURITY

Biological security is a field of security study that links public health to national security and it focuses on the two primary threats of bioterrorism and infectious diseases. Biosecurity utilizes all national instruments of power to improve the nation's defences against biological attacks and infectious outbreaks. Generally, biosecurity can be broken down into two major components: 1) Detection, Surveillance and Prevention, and 2) Preparedness, Response and Recovery.

3.1 GENESIS OF BIOLOGICAL SECURITY

Previously, security experts have always viewed biological attacks solely as a military threat and that infectious disease falls under the domain of public health. Both biological weapons and infectious diseases were rarely linked and discussed as part of a larger problem set that affects national security. However, the lines began to blur as novels and articles in the late 1980s and early 1990s began to describe emerging infectious disease and the appalling state of nonreadiness within the US national security plans to counter such disease threats. Books such as journalist Laurie Garrett's *The Coming Plague* and virologist Stephen Morse and Nobel Prize winner Joshua Lederberg's landmark volume, *Emerging Viruses* revealed just how "ill-prepared we are to detect global epidemic disease threats in a timely fashion, and, once detected, to respond appropriately."²³ Garrett argued that the approach at that time of developing a global system for detecting and managing outbreak was too technical and narrow in focus. She added that the scientific approach failed to address two fundamental sources of the problem, namely the failing public health system and the worsening in global living conditions. These two social problems must be addressed in order to provide security against emerging pathogens.²⁴

By the late 1990s, infectious disease began to gain greater prominence within the national security community. In 1998, the John Hopkins Center for Civilian Biodefense Strategies was founded to focus on emerging disease and counter-proliferation of bioweapons knowledge. The Centers for Disease Control (CDC) also developed several initiatives in response to bioterrorism while the Office of Bioterrorism Preparedness and Response began to distribute \$40 million per year in bioterrorism grant to local public health departments.²⁵

In June 2001, the Hopkins biodefense center collaborated with the Center for Strategic and International Studies to design a table-top exercise, called "Dark Winter," to simulate a smallpox attack on the United States. The exercise was aimed at many influential

national security experts and government officials, including former Senator, Sam Nunn, and former Director of Central Intelligence, James Woosley, and the scenario was set in three successive National Security Council (NSC) meetings depicted over a time span of two weeks after the initial attack. At the end of the two weeks, the stockpile of vaccine had been depleted, civil unrest and riots occurred in numerous sites, over fourteen thousand reported cases and one thousand dead, and the medical system was completely overwhelmed.²⁶ The participants, stunned by the chilling sense of realism, were shocked at the lack of preparedness and effective responses demonstrated by the exercise.

For many, 'Dark Winter' was a water-shed moment as it revealed a number of critical vulnerabilities. As the crisis unfolded, the public health systems were unable to rapidly provide vital information, which then inhibited the leaders' situational awareness. Furthermore, the stockpile of vaccines was simply insufficient to manage the crisis properly. Finally, the exercise exposed a "gulf between public health and national security expertise." As commented by Woosley, "it isn't just [a matter of] buying more vaccine, it's a question of how we integrate these public health and national security communities in ways that allow us to deal with various facets of the problem."²⁷ Essentially, 'Dark Winter' provided the momentum for the US government to take urgent notice of biosecurity and begin to allocate substantially more resources to improve its level of preparedness.

3.2 DETECTION, SURVEILLANCE AND PREVENTION

The first half of biosecurity involves the detection and surveillance of biological threats, and the subsequent prevention of such threats from occurring. A two-prong approach is required and the first prong focuses on the potential perpetrators of bioterrorism. Embedded within the current fight against terrorism, the ability to detect possible terrorist cells with the intention and capability to acquire and utilize biological weapons is vital. National intelligence agencies need to work closely with international counterparts to

establish an effective intelligence network to share vital information and monitor possible bioterrorist plots.

The second prong focuses on the biological agent. A robust epidemiological surveillance is crucial to detect any possible infectious outbreak and even possibly determine if a bioterrorist attack has occurred. By linking military and civilian surveillance resources properly, a network of sensors can be constructed to accurately and rapidly detect any abnormalities within population health. There is also a need to enforce high standards on personnel who handle potentially toxic biological materials, such as the medical research community, to manage these materials in a safe and responsible manner.

3.3 PREPAREDNESS, RESPONSE AND RECOVERY

The second half of biosecurity concentrates on preparing a nation to respond effectively upon the occurrence of a biological terrorist attack or an infectious disease outbreak and then to recover to a state of normalcy as quickly as possible. The list of actions to be taken include providing proper training to law enforcement agents and emergency responders, producing and stockpiling vaccines, strengthening hospital surge capacity, educating and communicating to the public, and most importantly, conducting scenario-based planning exercises. These scenario-based exercises are essential to test the robustness of the response systems and to identify potential gaps and vulnerabilities.²⁸ Short of an actual biological event occurring, such exercises are the best way to gauge the effectiveness of any emergency preparedness plan.

3.4 CHALLENGES

In order to ensure the government's efforts to protect its population and systems against biological threats are not wasted, there are certain challenges that need to be addressed. Three such challenges illustrate the level of difficulty and complexity within the

domain of biosecurity: Integrating Biosecurity, Allocation of Resources, and Ethical Implications and Civil Liberties.

Integrating Biosecurity

One of the greatest challenges to biosecurity is its cross-domain, multi-disciplinary nature. In order to execute an effective biosecurity strategy, it will require commitment from a myriad of actors, such as public health officials, the military, law enforcement agencies, pharmaceutical companies and the media. However, due to differing interests, motivations and organizational cultures, barriers between these actors are formed. These barriers must be eliminated, or at least minimized, in order to integrate biosecurity. The federal government, down to the state and local levels, needs to assert strong leadership in order formulate common objectives that are accepted by all actors and establish proper protocols to facilitate inter-agency operations.

Allocation of Resources

The allocation of resources to biosecurity has attracted a great deal of criticisms from both its supporters and detractors. Supporters of biosecurity insisted that the amount of resources was inadequate to provide proper protection for the population. They frequently cite examples, such as the recent woefully inadequate H1N1 vaccination program, to support their demands for additional resources. Meanwhile, critics observed that only two successful bioterrorist attacks have occurred in United States thus far and argued that the overall risk of bioterrorism remains low. They claimed that resources allocated to biosecurity have been diverted from more pressing public health problems, such as HIV/AIDS prevention.²⁹

Ethical Implications and Civil Liberties

Recognizing the need to take strong measures in order to halt the spread of the biological pathogen, the Centers for Law and the Public's Health released a Model State Emergency Health Powers Act (MSEHPA) in October 2001. The MSEHPA was intended to

serve as a template for state-level legislative reform, and codified mechanism under which the state could collect personal information, exercise powers of isolation and quarantine, and require mandatory medical testing, treatment and vaccination when faced with an imminent biological threat. Examples, such as the MSEHAP, where civil liberties are in conflict with the state's responsibility to protect public health and security have sparked strong debates.³⁰ If such concerns over the infringement of civil liberties are not addressed, it could potentially lead to civil unrests and violence during times of crisis.

4. NATIONAL EFFORTS

Since the September 11 terrorist attacks in 2001 and the SARS crisis in 2003, many countries have made great strides in strengthening their emergency response systems. The United States and Singapore are two good examples to showcase the various measures taken to counter imminent biological threats.

4.1 UNITED STATES' BIOSECURITY EFFORTS

Following Exercise 'Dark Winter', the US government has taken a more proactive stance towards biosecurity and implemented numerous initiatives to enhance the robustness of its national emergency response systems. The foremost step was the formation of the Department of Homeland Security (DHS). DHS serves as the primary executive agency to coordinate between various federal stakeholders, such as the Department of Health and Human Services (HHS) and Department of Defense (DoD), and achieve a more integrated approach towards biosecurity. DHS has established a number of cross-departmental working groups and committees to address critical issues ranging from interoperability to emergency communications and response. DHS has also initiated a series of programs to prevent and prepare for bioterrorism in accordance to the Sept. 11 commission's 2004 security recommendations.³¹ This included the Container Security Initiative and improvements in the U.S. Coast Guard's ability to intercept potential hazardous materials.

Of the \$50.5 billion DHS budget in fiscal year 2009, \$6.5 billion was allocated to the Federal Emergency Management Agency (FEMA) to “build a nimble effective emergency response system and culture of preparedness.” An additional \$2.2 billion grant was given to support FEMA’s state and local assistance programs to prepare against threats or incidents of terrorism and other catastrophic events.³² To boost the resiliency and protection of critical infrastructure and key resources, \$100 million was apportioned by DHS. The Office of Health Affairs invested more than \$2 billion in initiatives such as Project BioShield (pharmaceutical and vaccine production) as well as the integration of the National Biosurveillance Integration System (NBIS) and the BioWatch (environmental pathogen detection) program.³³ In fiscal year 2010, HHS has allocated \$4.6 billion in areas of bioterrorism and emergency preparedness as well as \$584 million to fund the HHS Pandemic Influenza Plan. In addition, President Obama requested a supplement of \$1.5 billion on April 28, 2009 to develop and distribute antivirals, vaccines, and personal protective equipment as well as conduct public health surveillance to track the outbreak.³⁴

Civil-military cooperation has also shown marked improvement, especially in areas of surveillance and detection. Under President Clinton’s directive in 1998, DoD formed the Global Emerging Infections Surveillance and Response System (GEIS) to develop techniques and institutions to fight disease in order to maintain “medical readiness” of the force, but also the health and security of the national population.³⁵ Inspired by the technical work of the New York City health department, DoD-GEIS would later design a surveillance system to gain early warning of unexpected outbreaks, known as the Electronic Surveillance System for the Early Notification of Community-based Epidemics (ESSENCE).³⁶ In collaboration with John Hopkins University, the military developed ESSENCE II in order to expand its field of surveillance to the civilian population, which essentially shifted epidemic detection from local to federal authorities.³⁷ ESSENCE II subsequently laid the bedrock for the development

of Biosense, which aims to “transform the many local syndromic surveillance systems into a coherent national picture.”³⁸ Currently, Biosense and Biowatch has been merged and integrated with NBIS, under the joint management of CDC and DHS.

Under the purview of DHS, numerous laws and regulations have been created to establish the proper protocol and measures in responding against a biological attack. Training and technical assistance is also provided to enhance the overall awareness and competency required. DHS is also responsible for the National Exercise Plan (NEP), a “congressionally mandated exercise program is designed to strengthen the nation’s capacity to prevent, protect against, respond to, and recover from terrorist attacks involving weapons of mass destruction or natural disasters.”³⁹

Finally, the DHS and other agencies will not be able to accomplish their objectives in a unified manner without an overarching strategy to provide clear directions.

In Nov 2009, the Obama administration released the *National Strategy for Countering Biological Threats*. The *Strategy* serves to align both current and future initiatives by providing a “framework for future United States Government planning efforts that supports the overall National Biodefense Strategy and complements existing White House strategies related to biological threat preparedness and response.”⁴⁰ The *Strategy* establishes seven objectives and prescribes possible actions to achieve such objectives: 1) Promote global health security, 2) Reinforce norms of safe and responsible conduct, 3) Obtain timely and accurate insight on current and emerging risks, 4) Take reasonable steps to reduce the potential for exploitation, 4) Expand our capability to prevent, attribute and apprehend, 5) Communicate effectively with all stakeholders, and 7) Transform the international dialogue.

4.2 SINGAPORE’S BIOSECURITY EFFORTS

Compared to the United States, Singapore represents the other end of spectrum in terms of size, resource and influence. As a highly globalized, tiny city-state with a dearth of

natural resources, Singapore is heavily dependent on the international trade and commerce for its continued survival and prosperity. Due to its strong links to the world economy, Singapore is unable to isolate itself completely in the face of any imminent biological threat. This problem is further exacerbated by its inherent vulnerability to global health trends. The 2003 SARS outbreak demonstrated Singapore's vulnerability and a lack of preparedness in responding against a catastrophic event.

By 2004, it was clear that the complex security landscape could not be addressed by the traditional stove piped manner of the Ministry of Defence (MINDEF) handling defence against external military threats while the Ministry of Home Affairs (MHA) dealt with internal security. It was also clear that in cases involving biosecurity, other key stakeholders such as the Ministry of Health (MOH) and the Ministry of the Environment and Water Resources (MEWR) must be involved. Based on the new Strategic Framework for national security laid out by Deputy Prime Minister Tony Tan, a new "National Security Coordination Secretariat (NSCS) was established in 2004 and tasked with national security planning and the coordination of policy and intelligence issues."⁴¹ Unlike DHS, which is an entirely new government entity, NSCS is designed to be a small coordinating body under the Prime Minister's Office that performs three vital security roles: National Security planning, policy coordination, and anticipating strategic threats.

In Fiscal Year 2009, the Singapore government has allocated \$367 million to the Civil Defence Programs while \$71 million will be spent to build up capabilities to respond to potential emergency health situations, such as influenza pandemic, bioterrorism and mass casualty events.⁴² One of the key focuses within this budgetary allocation is the build-up of chemical, biological, radiological and explosives (CBRE) capability.

The Singapore Armed Forces (SAF) and the Singapore Civil Defence Force (SCDF) have specialised units that are dedicated to respond against CBRE threats. Over the years, the

SAF and SCDF have been trying to procure the latest CBRE technology such as lightweight decontamination, detection, identification and disruption devices as well as unmanned biomorphic autonomous robots.⁴³ The SAF, SCDF, and other relevant agencies are also involved in large scale simulated emergency exercises, termed as Exercise North Star. In 2005, Exercise North Star V simulated chemical and biological terrorist attacks on Singapore land transport systems. The exercise was an excellent opportunity to test and improve the collective response of the government and the community against a bioterrorist incident.

After the SARS episode, the Singapore government realised that the spread of biological pathogen is no longer a public health issue and the associated socioeconomic and psychological impact can be disproportionate to the actual mortality rate. This meant that a whole of government approach was necessary to ensure a robust preparedness and response system is established to cover all sectors. Drawing lessons from the SARS outbreak, the MOH began to revamp its hospital systems and invest in new infrastructure to ensure sufficient capacity to counter any surge during a bioterrorist attack or infectious outbreak. Under the coordination of NSCS, various ministries are required to synchronize their contingency plans into a coherent national response system. National resources, such as the military and police, are also expected to perform duties beyond their normal jurisdiction. A good example was relying on the military to strengthen MOH's operational capabilities during the SARS crisis. Additional manpower and resources were drawn from MINDEF and SAF to manage vital systems and processes such as contact tracing and the implementing home quarantine order.⁴⁴

The government also learned that responsible media coverage and effective public awareness campaign was necessary to minimize the unwarranted fear and paranoia, while mobilizing the population to assume social responsibility was vital in eradicating the biological threat. By placing public order and security as much higher priorities compared to

civil rights and democratic processes, the government adopted the militaristic campaign “War on SARS” in 2003 to legitimize the harsh measures taken to curb the spread of disease.

Coupled with an effective public awareness campaign to enhance the overall level of public consciousness, the “War on SARS” proved to be extremely successful as it led to general agreement and support for the many initiatives taken by the state, as well as endorsement of the speed with which the problem was tackled.⁴⁵ This also helped to reduce the level of fear and uncertainty that would otherwise likely cripple Singapore’s economy.

The Singapore government is tackling the current influenza pandemic (H1N1) in similar fashion. With a focus on managing public fears and uncertainty, it has allocated substantial resources to detect and contain the biological threat while implementing an extensive media campaign to raise public awareness. The government has also maintained transparency through updated websites and frequent news releases in order to instil public confidence in its policies and measures.

5. INTERNATIONAL EFFORTS

Like most unconventional security threats, biosecurity cannot be managed in isolation. Issues such as border control and international trade in live stock and agriculture products are severely impacted by the threat of biological pathogens and require the coordination of affected states to respond against any catastrophic event. International organizations such as UN’s World Health Organization (WHO) and Biological Weapons Convention (BWC) are two pivotal instruments to provide a common platform for states to cooperate and coordinate their biosecurity efforts.

World Health Organization (WHO)

In order to counter such biological threats, the international community must to work together in areas such as information sharing, transfer of medical knowledge and technology, and policy coordination. WHO serves as the principle international agency to provide the

necessary leadership and guidance on matters related to infectious diseases. Since the 2003 SARS outbreak, WHO has played an increasingly vital role in consolidating and sharing critical data on infectious disease outbreak while establishing protocols for its 193 member states to effectively counter biological threats.

One of WHO's most critical biosecurity documents is the International Health Regulations (IHR). The aim of this legally-binding agreement is to help the international community prevent and respond to acute public health risks that have the potential to cross borders and threaten people worldwide. Entered into force on June 15, 2007, the IHR required states to report certain disease outbreaks and public health events to WHO. "Building on the unique experience of WHO in global disease surveillance, alert and response, the IHR defined the rights and obligations of countries to report public health events, and establish a number of procedures that WHO must follow in its work to uphold global public health security."⁴⁶

In addition to providing a framework to manage disease outbreak, the IHR also established key milestones for member states to develop their national surveillance and response systems. Other significant initiatives include the Global Alert and Response (GAR) program, an integrated global alert and response system for epidemics,⁴⁷ and the Centre for Strategic Health Operations (SHOC), which serve as the nerve centre of WHO's global epidemic response to provide a single point of coordination for response to acute public health crises.⁴⁸

Biological Weapons Convention (BWC)

BWC is the key international forum to counter the proliferation of biological weapons. The Convention prohibits the development, production, and stockpiling of weaponized disease agents, and has 163 member states that have pledged against the use of bioweapons. In addition to the annual meetings that establish the global objectives for limiting bioweapons,

the UN's Geneva office hosts two meetings annually, as part of the convention's "intercessional process", to allow experts to meet and discuss on related topics. Conclusions of such discussions will be evaluated by member states and recommendations will be passed along to the convention's review conference. The latest topic under discussion is disease surveillance.⁴⁹

After the Bush administration withdrew from BWC negotiations aimed at creating an inspections protocol in 2001, the Obama administration has decided to engage the BWC, based on the *2009 National Strategy for Countering Biological Threats*. According to the U.S. Under Secretary of State Ellen Tauscher's address to the BWC's state parties in Dec 2009, the U.S. government has affirmed its commitment to "reinvigorate the BWC as the premier forum for global outreach and coordination," and stated its three primary goals of increasing transparency, improving confidence building measures and engaging in more robust bilateral compliance discussions.⁵⁰ The commitment of US towards BWC is a positive step towards establishing proper compliance checking mechanisms on bioweapons while providing assistance to member states to enhance their capabilities in countering infectious disease threats and to improve their biosafety measures and training.

6. FUTURE OF BIOSECURITY

Despite of the tremendous effort and resources invested in biosecurity, there is still a substantial amount of work that needs to be done. The U.S. Congressional Commission on the Prevention of Weapons of Mass Destruction Proliferation and Terrorism has recently graded the Obama administration an 'F' for bioterrorism defense.⁵¹ Although the commission gave positive results for the comprehensive review of domestic programs to secure dangerous pathogens and the reengagement of the BWC, it cited the "absence of a comprehensive U.S. capability to rapidly recognize, respond to and recover from a disease-based attack" as the most "significant failure."⁵²

The commission's report card clearly demonstrates the need for a relentless effort on developing a robust detection and response system against biological threat. Responding to the commission's scathing report, President Obama vowed to boost the capacity to combat bioterrorism and infectious disease in the 2010 State of the Union Address. He declared to "launch a new initiative that would provide the capacity to respond faster and more effectively to bioterrorism or an infectious disease, a plan that would counter threats at home and strengthen public health abroad."⁵³ Significant funding is likely to be channelled into developing "broad-spectrum technology" to rapidly create and produce new vaccines, and "broad-spectrum platforms" to shorten and streamline processes so as to reduce the time and cost required to deliver the medical countermeasures.⁵⁴

While it is important to allocate sufficient resources to develop technological-based countermeasures, there are two other important facets of biosecurity that cannot be neglected: the citizens' mental resiliency in responding to biological threats and a system that leverages on community-based civil resources, such as vehicles and medical supplies, to recover against a bioterrorist attack or an infectious outbreak. States must develop a coherent strategy to involve the civil society in developing countermeasures against biological threats. An effective communications campaign led by the grassroots leaders will instil greater mental resiliency within the population. In addition, the strategy should consolidate civil resources at the local level as part of the national preparedness plan. These community-based civil resources identified to response against biological threats will ensure a high level of responsiveness while managing the cost of biosecurity.

On the international arena, both the WHO and BWC have demonstrated remarkable efforts in coordinating global efforts to counter biological threats. Moving forward, there is a need for these relevant international organizations to get together and establish clearly defined areas of responsibility. The BWC's focus on disease surveillance has received

criticism from some experts as it was deemed to be 'overstepping' on WHO's boundary. The experts claimed that BWC should narrow its focus on intentional acts of bioterrorism instead of natural outbreaks.⁵⁵ Although it is logical for BWC to adopt a broader view on biological threats and develop common approaches to detection and response, the future of biosecurity will require BWC to synchronize its efforts with WHO and other pertinent international organizations such as the World Organization for Animal Health (OIE) and Food and Agriculture Organization (FAO). Interactions between such organizations will strengthen the linkages between the global security and public health communities, and generate greater synergy to minimize the risk of biological threats on a global scale.

8. CONCLUSION

Biosecurity will continue to dominate our security environment as the world continues to globalize. The possibility of terrorist groups engaging in bioterrorism is no longer a question of 'if' but, rather, a question of 'when'. At the same time, infectious diseases such as the H1N1 influenza and avian flu continue to overwhelm the global health systems and threaten national security. These threats require the combined efforts of international organizations, local and state governments, and the civil society to establish a robust respond system while cooperation between the medical professions, scientific community, and pharmaceutical industry will be essential to develop effective countermeasures.

The key to these combined efforts and cooperation is the emphasis on the integration of biosecurity. The wide array of entities involved in the designing, planning and execution of biosecurity strategies and policies illustrates the level of complexity involved in addressing biological threats. Hence, achieving greater integration within the sphere of biosecurity should be given priority in terms of attention and resources in order to stage an effective global defense against bioterrorism and infectious diseases.

Appendix A: Dual Purpose Dilemma of Biodefense Research

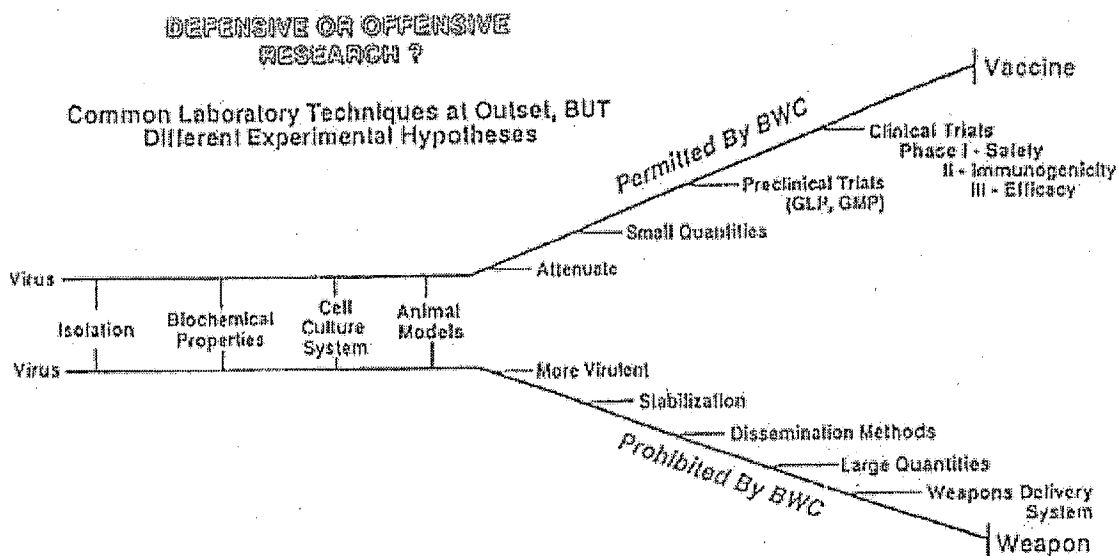


Figure 1. Defensive or Offensive Research?

Source: Figure 2-7: *Offense or Defense? It's Hard to Tell* from Daniel M. Gerstein, *Bioterror in the 21st Century*, (Annapolis, MD: Naval Institute Press, 2009), 64.

Appendix B: Impact of Biotechnology on Biological Threat

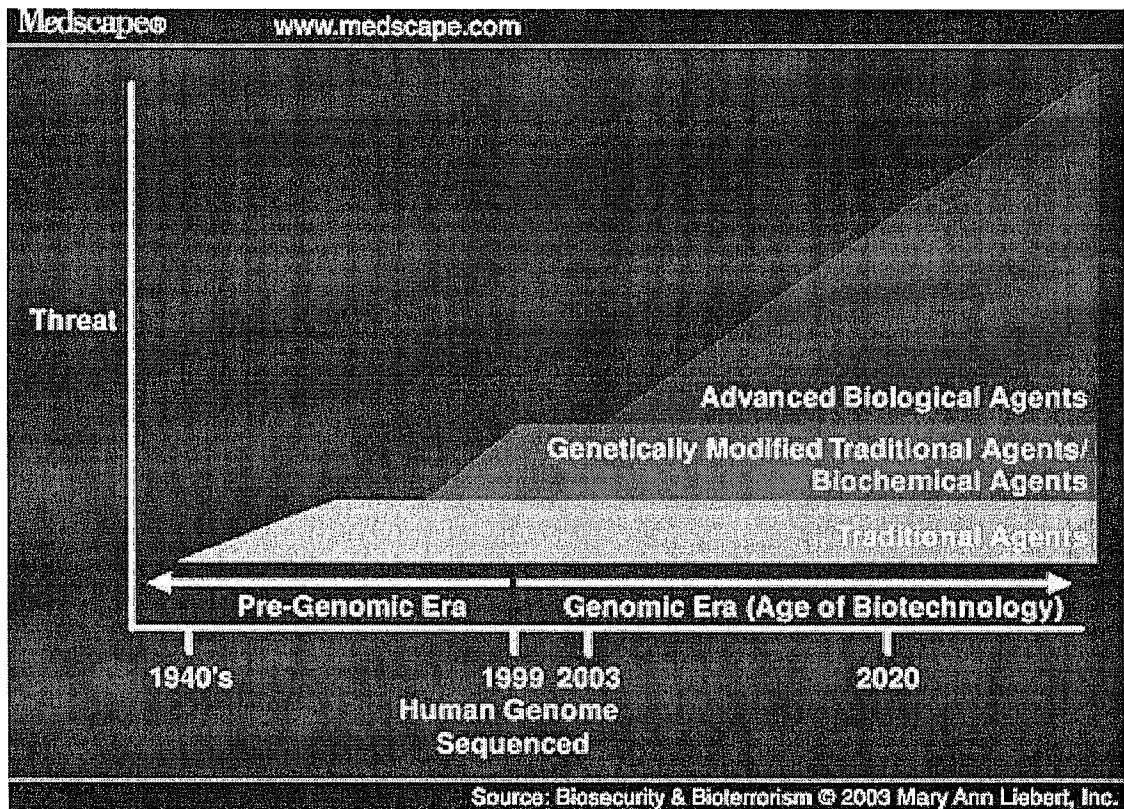


Figure 2. Impact of Biotechnology on Biological Warfare and Biodefense

Source: Medscape Today website: *Biotechnology: Impact on Biological Warfare and Biodefense* - http://www.medscape.com/viewarticle/462541_3 (accessed on Feb 24, 2010)

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